بسم الله الرحمن الرحيم

King Fahd University of Petroleum and Minerals

Aerospace Engineering Department

AE Experimental and Computational Methods

Presentation Layout

- Experimental Methods
- Computational Methods
  - MATLAB
  - FLUENT
- Conclusion

Experimental Methods

AE Labs

Aerodynamics Lab

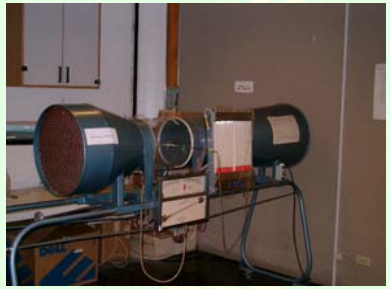
Wind Tunnel Lab

Airplane Lab

Experimental Methods (contd.)

- **Subsonic Wind Tunnel**

- **Educational Wind Tunnel**



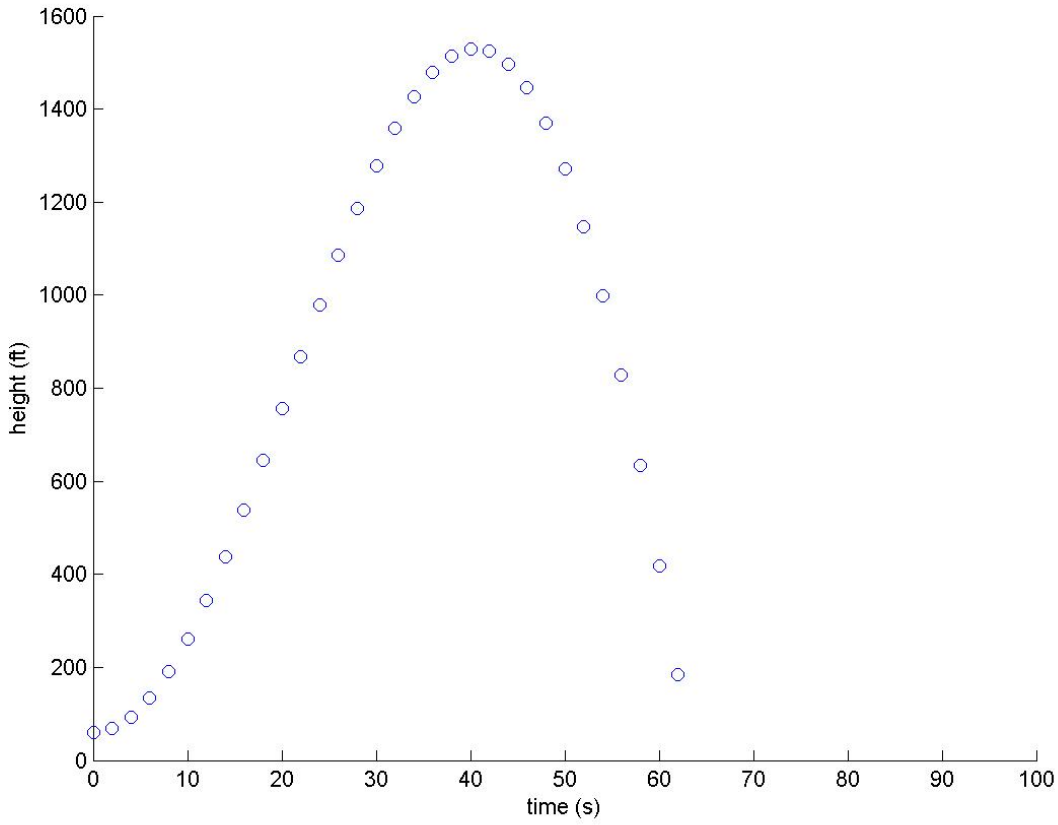
- **Flow Bench**

Computational Methods

- **MATLAB**
  - **It is a very strong programming tool for the engineering discipline**
  - **It is utilized to obtain the Numerical and Analytical Solutions related to Aerospace Engineering problems.**
  - **Some of the examples of the application of MATLAB are:**

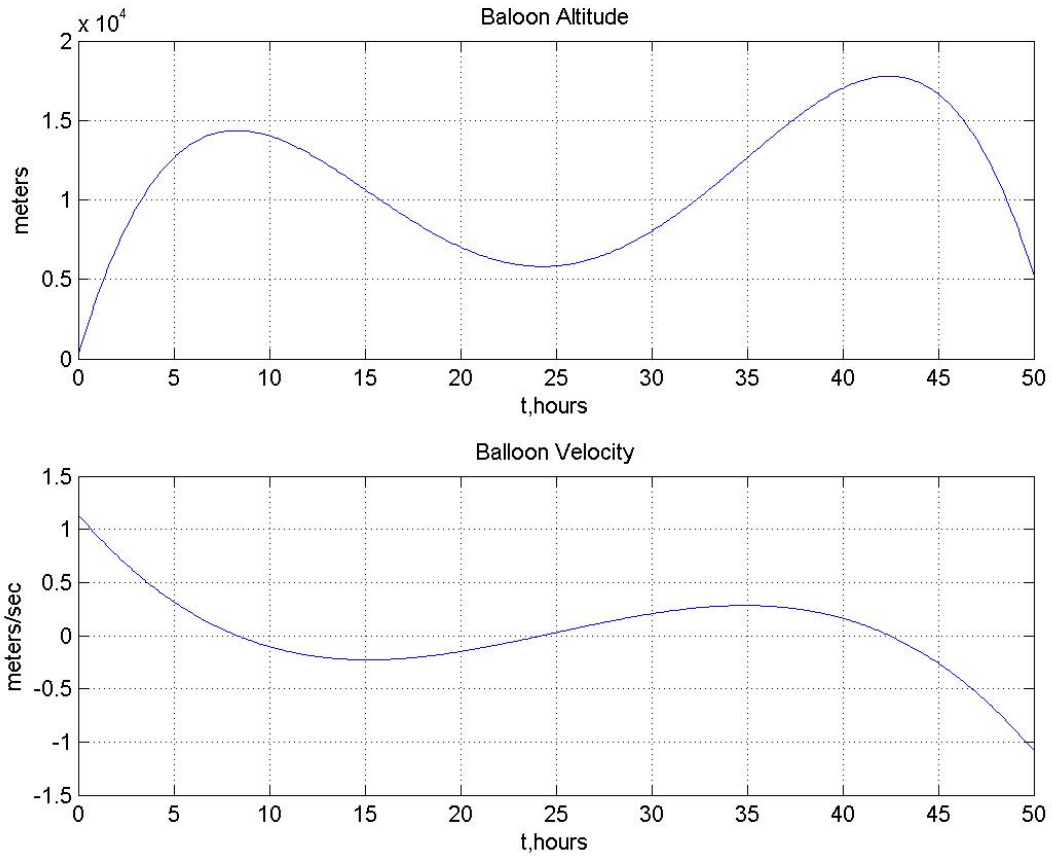
Ex. 1: Rocket Trajectory

$$height = 60 + 2.13t^2 - 0.0013t^4 + 0.000034t^{4.751}$$



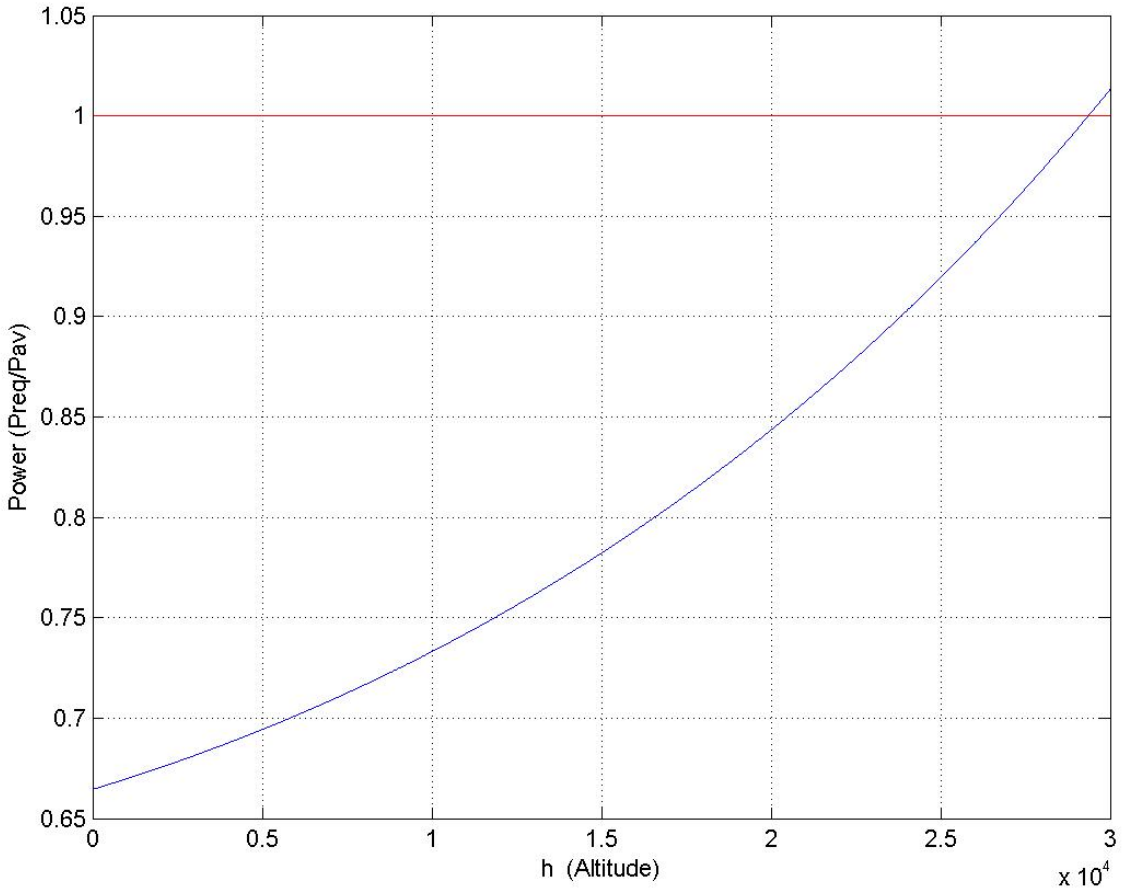
Ex. 1: Weather Balloon Altitude Profile

$$h(t) = -0.12t^4 + 12t^3 - 380t^2 + 4100t + 220$$



Helicopter Performance

$$P_m = KT_m V_m + \rho(\Omega_m R_m)^3 A_m \left(\sigma_m \frac{C_{d,0}}{8} \right)$$



Computational Methods

- **FLUENT**
  - **It is a very strong computational tool for the engineering discipline**
  - **It is utilized to obtain the Numerical Solutions related to Aerospace Engineering problems.**

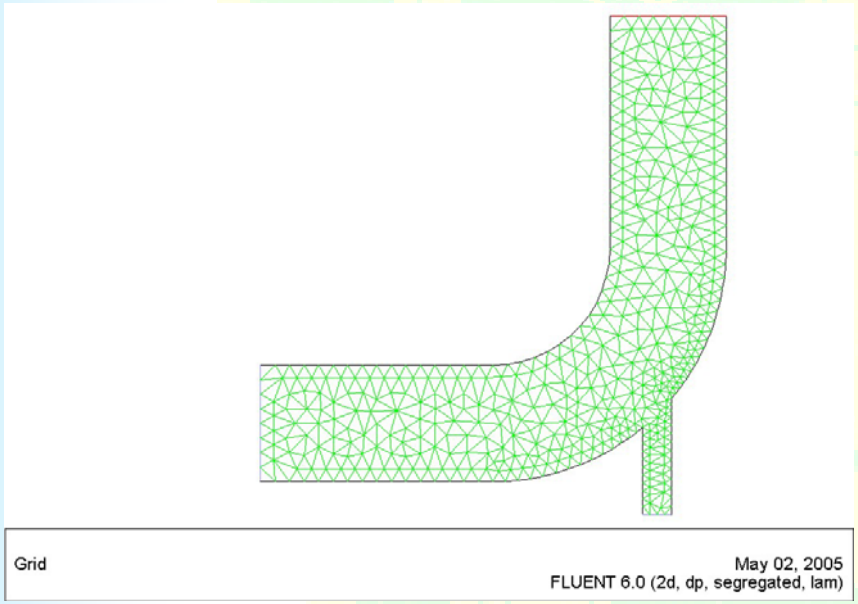
FLUENT Pre-processors

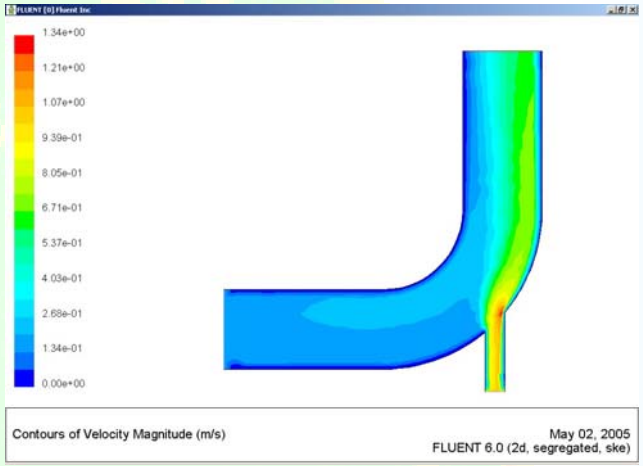
- **FLUENT Inc.**
  - **Gambit**
  - **G/Turbo**
  - **TGrid**
- **Third Party Pre-processors**
  - **ICEM CFD**
  - **GridGen**
  - **GridPro**

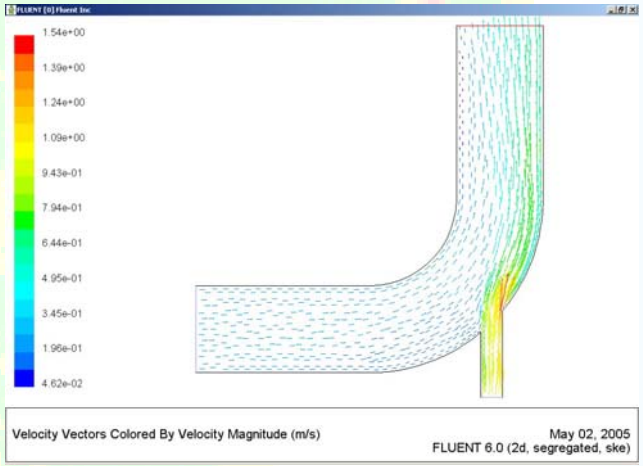
Examples of the application of FLUENT

- CFD for internal flow.
- CFD for external flow.

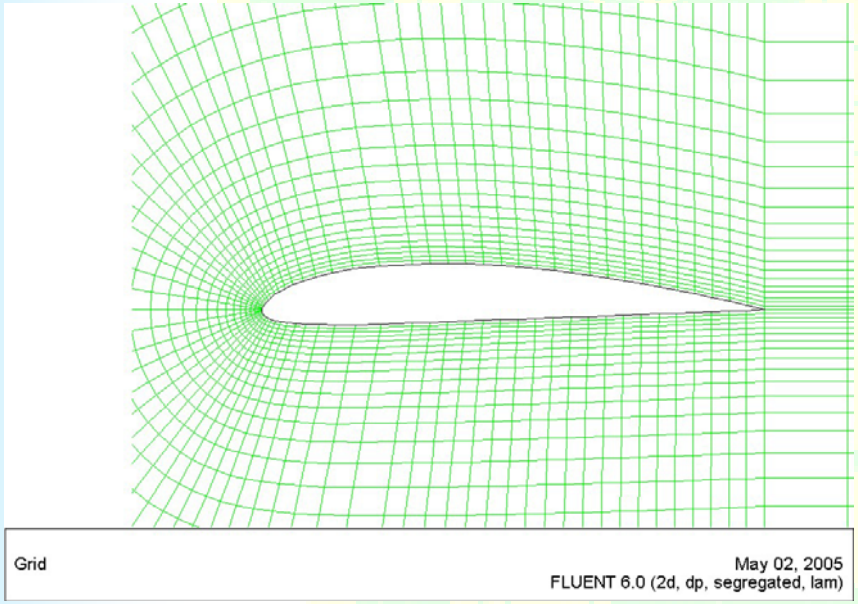
CFD for Internal Flow

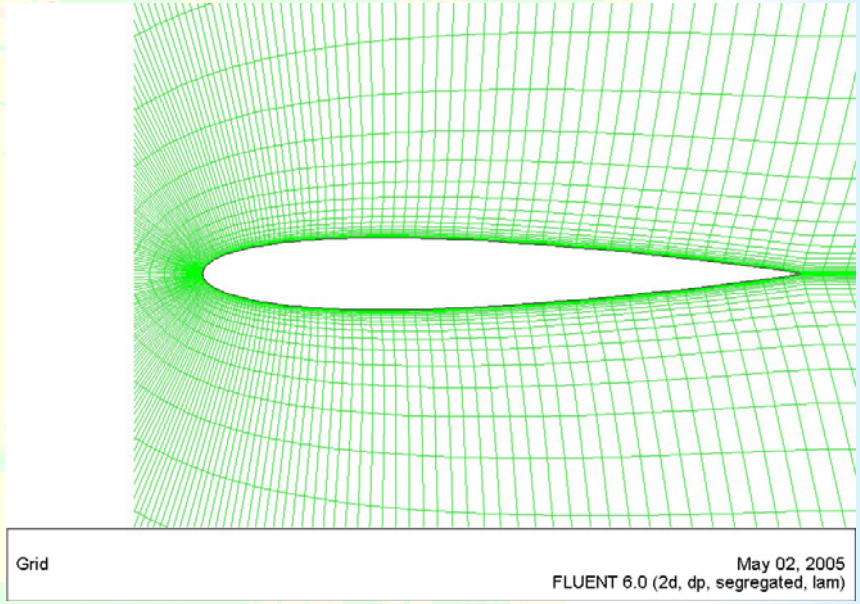




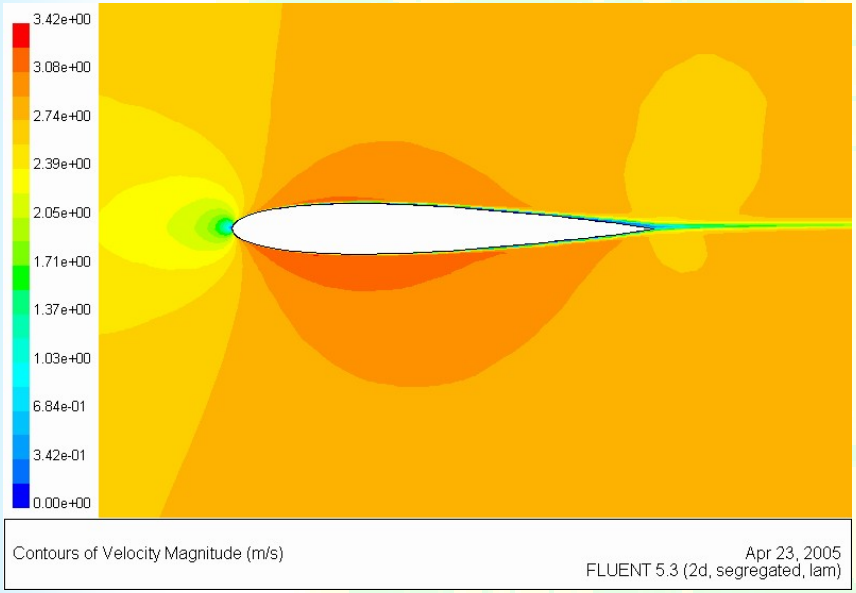


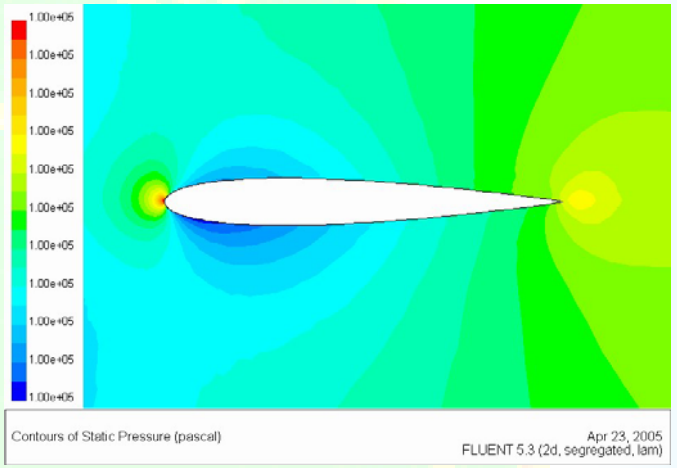
CFD for External Flow

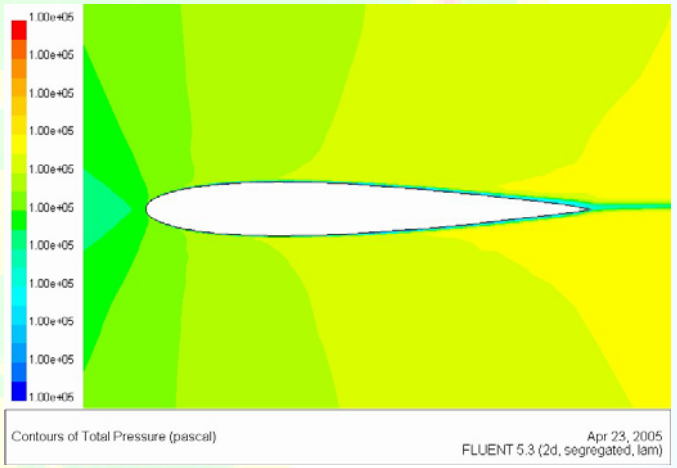




CFD for External Flow (contd.)







Conclusion

- Aerospace Engineering Department utilizes the AE labs for teaching and research experiments by utilizing Wind Tunnel, Flight Simulator Wind Tunnel, Flow Bench etc.

- Computational techniques using the software such as MATLAB, FLUENT, etc. are implemented at different expertise levels to solve AE problems in all the AE undergraduate and graduate level courses.

- The aim is to indulge in the AE students the skills of designing and performing experiments, and utilizing computational technique in studies and future professional careers.

Thank You

Questions